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*Original Research*

# Delayed cholecystectomy after cholecystostomy versus early cholecystectomy in acute cholecystitis

Cholecystectomy after percutaneous cholecystostomy

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**Abstract**

Aim: In this study we aimed to compare early laparoscopic cholecystectomy and delayed laparoscopic cholecystectomy after percutaneous cholecystostomy for acute cholecystitis with respect to operative characteristics, complications and hospital stay.

Material and Methods: A total of 225 files of patients who admitted to the hospital with acute calculous cholecystitis were retrospectively analyzed. Patients who underwent open cholecystectomy, delayed cholecystectomy, who refused surgical treatment, or there was a lack of data were not included in the study.

Results: Seventy-eight patients who underwent early laparoscopic cholecystectomy [EC group], and 61 patients who underwent delayed laparoscopic cholecystectomy after percutaneous cholecystostomy [DC group] were included in this study. There were no differences between genders or BMI- associated comorbidities between the two groups. The median age was 60 [29-81] in the EC and 75 [56-87] in the DC groups. Age and ASA scores were significantly higher in the DC group [p <0.05]. The operation times in the EC and DC groups were 67.78 [±12.66] and 62.50 [±12.56] minutes, respectively, and were significantly longer in the EC group [p <0.05]. Converted open procedure, another complication and mortality were not different between boths groups. Hospitalization time was longer in the EC group [3.95 ±1.49 vs. 2.16 ±1.28, p<0.001].

Discussion: In the treatment of acute calculous cholecystitis for patients who are not suitable for early surgery, delayed laparoscopic cholecystectomy after percutaneous cholecystectomy does not increase surgical complications, hospital stay, and mortality.

**Keywords**

Acute Cholecystitis, Percutaneous Cholecystostomy, Laparoscopic Cholecystectomy, Delayed Laparoscopic Cholecystectomy

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## Introduction

Cholelithiasis, one of the most common diseases of the digestive system, and occurs in 10-20% of adults, and its incidence increases with age [1, 2]. Laparoscopic cholecystectomy [LC] has become the gold standard in the surgical treatment of cholelithiasis due to shorter hospitalization, faster recovery, and postoperative complications than open cholecystectomy.

LC has recently become the first choice in the treatment of acute cholecystitis [3-6]. However, the severity of acute cholecystitis ranges from mild to moderate to severe [7]. According to the Tokyo guidelines, patients with acute cholecystitis can be treated with early cholecystectomy or percutaneous cholecystostomy, with medications and delayed cholecystectomy [8,9]. For patients with stage I and some stage 2 acute cholecystitis, early laparoscopic cholecystectomy may be the most appropriate treatment. Percutaneous cholecystostomy may be appropriate for patients with Stage II or III acute cholecystitis if surgery is at risk due to comorbidity and advanced age [10-14]. The cholecystostomy tube can be removed in about four weeks. Elective laparoscopic cholecystectomy can be planned in about 6 to 8 weeks [15].

There are limited data in the literature regarding the perioperative outcomes of delayed laparoscopic cholecystectomy after percutaneous cholecystostomy for acute cholecystitis. The purpose of the present study was to compare delayed laparoscopic cholecystectomy after percutaneous cholecystostomy versus early laparoscopic cholecystectomy in Acute Cholecystitis.

## Material and Methods

The study was conducted in the Department of General Surgery of a tertiary reference hospital. University of Health Sciences Hamidiye Scientific Research Ethics Committee approved the study protocol [number 17/2, dated July 01, 2022]. Written informed consent was obtained from all participants. This study complies with the 1964 Declaration of Helsinki and its subsequent amendments and ethical standards.Between January 2012 and December 2017, the data of 225 patients hospitalized with a diagnosis of acute calculous cholecystitis were retrospectively analyzed.

The following TG13 criteria were used for the diagnosis of acute cholecystitis.

A. Local signs of inflammation etc.

1. Murphy's sign, 2. RUQ mass / pain / tenderness

B. Systemic symptoms of inflammation etc.

1. Fever, 2. Elevated CRP, 3.Raised WBC count

C. Imaging findings

The criteria for imaging findings characteristic of acute cholecystitis:

Suspected diagnosis: One item in A + one item in B

Definite diagnosis: One piece in A + one item in B + C

Acute calculous cholecystitis was staged according to ASA scores and TG13 criteria, and the treatment strategy was determined [9]. Patients who decided to have laparoscopic cholecystectomy were operated on within the first 72 hours. The Tokyo severity criteria guidelines for acute cholecystitis are presented in Table 1.

Abdominal ultrasonography, complete blood count, prothrombin and partial thromboplastin times, the international normalized ratio [INR], and platelet counts were determined for patients undergoing percutaneous cholecystostomy due to advanced ASA score or stage III acute cholecystitis. Those with INR <1.5 and platelet count >100.000/ml were considered suitable for percutaneous treatment. All percutaneous treatment procedures were performed under local anesthesia with USG and fluoroscopy.

Percutaneous cholecystostomy patients were discharged from the hospital after their septic condition improved. Percutaneous cholangiography was performed at the end of 3-4 weeks to check whether the cystic duct was intact. Percutaneous drains of the patients with the entire cystic duct were removed. The draining of the patients whose cystic duct was not intact in the cholangiography was left in place for 6-8 weeks and was removed during the operation. Percutaneous cholecystostomy patients were re-consulted by anesthesiologists at the end of the 6-8th week, and a laparoscopic cholecystectomy was performed.

Demographic characteristics of the patients, acute cholecystitis levels according to TG13 severity scores, ASA scores, treatment methods, length of hospital stay, duration of surgery, intraoperative complications, additional surgical interventions, morbidity and mortality were recorded.

### *Data Entry and Statistical Analysis*

The Kolmogorov-Smirnov normality test was performed to select statistical methods. If no normality assumption occurred in any of the groups, nonparametric test methods were preferred. The Mann-Whitney U test was used to compare the variables obtained from the measurements between the two groups, and chi-square and Fisher exact tests were used to compare the categorical variables.

Group comparison results related to the research and other demographic features were presented through a ratio of qualitative variables and the averages of quantitative variables. These quantities were interpreted with p-values, which are expressions of statistical significance. The Social Sciences Statistical Package [SPSS], version 17.0 [SPSS Inc., Chicago, IL, United States of America] program was used to conduct statistical analysis of the research, and $p < 0.05$ was accepted as the statistical significance limit.

## Results

Between January 2012 and December 2017, a total of 225 patients with acute calculous cholecystitis, according to TG13 criteria, were hospitalized. The study did not include 43 patients who underwent delayed laparoscopic cholecystectomy, seven patients who underwent open cholecystectomy, 12 patients whose files were missing, 14 patients who refused surgical treatment, and 10 patients for other reasons [feasibility, 61.8%] [139 of 225]. Thus, 78 patients who underwent early laparoscopic cholecystectomy [EC group], and 61 patients who underwent delayed laparoscopic cholecystectomy after percutaneous cholecystostomy [DC group] were included in this study. The study flow diagram is shown in Figure 1.

Of the 139 patients included in the study, 77 [55.4%] were women, and 62 [44.6%] were men. There was no difference between the two groups [p> 0.05] in terms of gender, BMI,

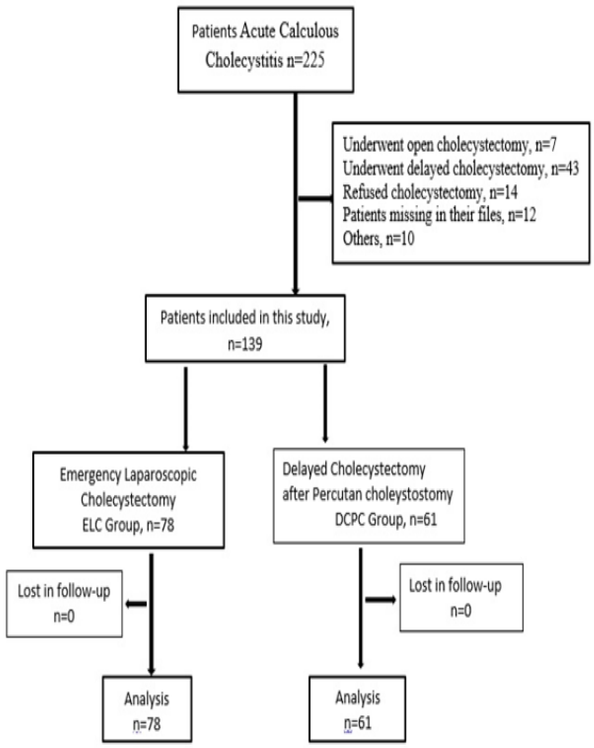


**Figure 1.** Flowchart diagram

**Table 1.** Tokyo guidelines severity criteria for acute cholecystitis

| |
|---|
| **Grade I** |
| Acute cholecystitis in a healthy patient with no organ dysfunction and mild inflammatory changes in the gallbladder |
| **Grade II** |
| Acute cholecystitis is associated with one of the following conditions: |
| 1. Elevated white blood cell count (>18,000/mm3) |
| 2. Palpable tender mass in the right upper abdominal quadrant |
| 3. Complaint duration >72 h |
| 4. Marked local inflammation (gangrenous cholecystitis, pericholecystic abscess, biliary peritonitis, emphysematous cholecystitis) |
| **Grade III** |
| Acute cholecystitis associated with failure of any of the following organs/systems: cardio-vascular, neurological, respiratory, renal, hepatic or hematological dysfunction. |

**Table 2.** Demographic characteristics

| | | EC Group (n= 78) | DC Group (n=61) | p |
|---|---|---|---|---|
| Age | | 59.86±10.18 | 72.92±6.94 | <0.001 |
| Gender (female/male) | | 44/34 | 33/28 | 0.786 |
| BMI | | 26,31 ±4,19 | 25.75 ±4.07 | 0,273 |
| Diabetes Mellitus | | 7(9,0) | 5(8,2) | 0,872 |
| Hypertension | | 6(7,7) | 4(6,6) | 0,798 |
| Cardiac failure | | 2(2,6) | 3(4,9) | 0,461 |
| COPD | | 4(5,1) | 4(6,6) | 0,721 |
| Smoking | | 3(3,8) | 3(4,9) | 0,758 |
| ASA | ASA I | 39(50) | 1(1,6) | <0.001 |
| | ASA II | 26(33,3) | 33(54,1) | |
| | ASA III | 13(16,7) | 27(44,3) | |

Data are presented as mean ± standard deviation or number (%), where appropriate

and associated comorbidities. The median age was 60 [29-81] years in the EC group and 75 [56-87] years in the DC group. Age and ASA scores were significantly higher in the DC group [p <0.05]. Demographic data are shown in Table 2.

The operation time in the EC and DC groups were 67.78 [±12.66] and 62.50 [±12.56] minutes, respectively, and was significantly longer in the EC group [p <0.05]. In the EC group, eight [10.3%] laparoscopic procedures were initiated but converted to the open method due to difficult dissection. Six [7.7%] patients underwent cholecystectomy, and 2 [2.6%] had a partial cholecystectomy. In the postoperative period, one [1.3%] patient was detected to have the Bismuth Type II injury; a hepaticojejunostomy was performed and discharged without any problems. Postoperative bleeding occurred in two [2.6%] patients, and superficial surgical area infection developed in 3 [3.8%] patients and they were treated conservatively. Two [2.6%] patients died in the early postoperative period due to comorbid diseases. In the DC group, 3 [4.9%] patients' laparoscopic procedures were initiated but converted to the open method due to a difficult dissection. Three [4.9%] patients developed bronchopneumonia, and one [1.6%] patient developed deep vein thrombosis and recovered with medical treatment in the postoperative period. Five [8.2%] patients died due to associated comorbidities. There was no statistically significant difference in operations that were converted to the open procedure, complications, and mortality between either of the groups, except bronchopneumonia [p> 0.05]. Bronchopneumonia was detected significantly more in the percutaneous cholecystectomy group. Hospitalization time was longer in the EC group [3.95 ±1.49 vs. 2.16 ±1.28, p<0.001]. Surgical features and complications are shown in Table 3.

## Discussion

The standard treatment of symptomatic cholelithiasis is laparoscopic cholecystectomy [2]. Laparoscopic cholecystectomy is also used in the treatment of acute calculous cholecystitis. Recent studies have shown that the operation can be performed with equivalent or improved morbidity, mortality, and length of stay, as well as a similar conversion rate to open cholecystectomy [3, 5, 16]. However, concerns remain among surgeons about catastrophic complications and biliary system injury. It has been reported that partial cholecystectomy can be performed in acute cholecystitis since severe inflammation

**Table 3.** Surgical features and complications of the groups

| | EC Group (n= 78) | DC Group (n=61) | p |
|---|---|---|---|
| Operation time (min) | 67,79±12,67 | 62,5±11,45 | 0,012 |
| Conversion to open procedure | 8(10.3%) | 3 (4.9%) | 0,68 |
| Open cholecystectomy | 6 (7.7) | 3 (4.9%) | 0,913 |
| Partial cholecystectomy | 2 (2.6) | 0 | 0,209 |
| Bile duct injury | 1 (1.3) | 0 | 0,377 |
| Postoperative bleeding | 2 (2.6) | 0 | 0,209 |
| Superficial surgical infections | 3 (3.8) | 0 | 0,123 |
| Postoperatively bronchopneumonia | 0 | 3 (4.9%) | 0,049 |
| Postoperatively deep vein thrombosis | 0 | 1 (1.6%) | 0,258 |
| Hospitalization time (day) | 3.95 ±1.49 | 2.16 ±1.28 | <0.001 |
| Mortality | 2(2.6%) | 5(8.2%) | 0,133 |

Data are presented as mean ± standard deviation or number (%), where appropriate

does not allow safe dissection of hilar structures. However, this procedure is not always reliable, and publications show that acute cholecystitis develops again [17]. For patients who are not medically suitable for surgery due to the severity of their illness, advanced age, or medical comorbidities, biliary decompression is achieved by percutaneous cholecystostomy and is planned for operation after stabilization. Laparoscopic cholecystectomy, assuming that the medical suitability is improved, can be scheduled 6-8 weeks after percutaneous cholecystostomy [18]. Percutaneous cholecystostomy is a life-saving procedure in severe acute cholecystitis. However, the definitive treatment of these patients is laparoscopic cholecystectomy and concerns among surgeons continue with regard to delayed laparoscopic cholecystectomy after percutaneous cholecystostomy, because of the difficulty of dissection and, the risk of injury in the biliary tract.

In this study, we investigated the effect of performing percutaneous cholecystostomy for acute cholecystitis on the operative outcomes of delayed laparoscopic cholecystectomy. The present study shows that early laparoscopic cholecystectomy and percutaneous cholecystostomy were able to improve cholecystitis sepsis in all of the patients quickly, and the mortality rates did not show any difference. The patients treated with percutaneous cholecystostomy were older than patients in the early laparoscopic cholecystectomy group. This is an expected outcome, and similar results were also presented by other studies [18, 19]. Furthermore, in this study, patients with percutaneous cholecystostomy had higher ASA scores than patients who underwent early laparoscopic cholecystectomy, which was not a surprising result. This is because, according to the criteria of TG13, it recommends avoiding laparoscopic cholecystectomy and minor interventions, such as percutaneous cholecystostomy, for patients with a high ASA score [10]. Other studies have shown that patients undergoing early cholecystostomy have a higher ASA score than patients undergoing percutaneous cholecystostomy [12, 20, 21].

In our study, the duration of surgery was shorter in patients who underwent laparoscopic cholecystectomy after percutaneous cholecystectomy. Our results are similar to other studies, where the operation time was also shorter among patients that underwent delayed laparoscopic cholecystectomy after percutaneous cholecystostomy [22, 23]. Difficulty in laparoscopic cholecystectomy is due to inflammation and edema of the dissection in Calot's triangle dissection. The dissection becomes more comfortable with reduced inflammation and edema in this area within 6-8 weeks following a percutaneous cholecystostomy. In early laparoscopic cholecystectomy, we evaluated the longer operation time as being a difficult dissection due to inflammation in the acute phase.

In our study, laparoscopic to open conversion rates for patients in the EC group were higher than in the DC group [10.3% vs. 4.9%]. However, this was not statistically significant [p =0.68]. These results show that the laparoscopic cholecystectomies planned after percutaneous cholecystostomy do not increase the risk of conversion to an open procedure. Kim et al. reported that patients' early laparoscopic cholecystectomy had a higher conversion frequency rate to open surgery was associated with delayed cholecystectomy after percutaneous cholecystostomy [22].

A study by Sippey et al. found that 7242 patients who underwent emergency cholecystectomy for acute cholecystitis who were converted to open procedure had advanced age and higher BMIs as risk factors [24]. In their prospective and multicentric study, Navez and colleagues were able to start the operations in 1015 of 1089 [93.2%] acute cholecystitis patients as a laparoscopic procedure, and out of them, 116 patients [11.4%] who underwent laparoscopic surgery required conversion to an open method. However, in other studies, the rate of conversion to an open procedure was higher in patients undergoing a percutaneous cholecystostomy [25]. Our research assumed that the reason for this was surgical intervention after waiting at least six weeks, and inflammation around the gallbladder decreased.

Departmental instructions state that the delayed period is at least 6-8 weeks, as practiced bymany authors who adopt the prolonged time interval to surgery. The purpose and rationale for percutaneous cholecystostomy are to relieve symptoms and improve acute cholecystitis sepsis with a less invasive method than medicine. This is achieved by reducing gallbladder distension through percutaneous cholecystostomy under local anesthesia. In addition, antibiotics and fluid therapy are applied and oral nutrition is stopped. Thus, time is obtained to optimize and prepare critical patients with acute cholecystitis for elective surgery instead of emergency surgery who are not otherwise suitable for surgery. The treatment strategy for patients with acute cholecystitis may differ in various centers, where the most common application is that patients with a comorbid disease and stage II acute cholecystitis and patients with stage III acute cholecystitis, according to TG13 criteria, are not suitable for surgery. Percutaneous cholecystostomy can be applied o prepare for surgery in the treatment of these patients.

Frequently performed with ultrasound guidance under local anesthesia with some sedation, percutaneous cholecystostomy can be a temporizing measure by draining the infected bile—percutaneous drainage results in an improvement in symptoms and physiology. In patients with cholecystostomy tubes, when fluoroscopy shows a patent cystic duct, the cholecystostomy tube can be removed after 3 to 4 weeks. Thus, cholecystectomy is determined by the patient's ability to tolerate surgical intervention and allow a delayed laparoscopic cholecystectomy 6 to 8 weeks after medical optimization.

In our study, patients who underwent early laparoscopic cholecystectomy due to acute cholecystitis were found to have significantly longer hospitalization [3.95 ±1.49 vs. 2.16 ±1.28 days]. A survey conducted by El-Gendi et al. found hospitalization times to be five times shorter in delayed laparoscopic cholecystectomy after percutaneous cholecystostomy, compared to early cholecystectomy for acute cholecystitis [10]. This period should be considered as a very different entity when viewed socially. As these patients were hospitalized twice, both in our study and in other studies, this seems to be a contradictory determination. Our hypothesis is whether the surgeon will be apprehensive of the surgery to be performed on patients who have previously undergone percutaneous cholecystostomy. It is a matter of whether it is

more difficult compared to early surgery. Our study showed that the laparoscopic cholecystectomy performed after percutaneous cholecystostomy for acute calculous cholecystitis is not a difficult procedure with the duration of surgery, the rate of conversion to open surgery, and the length of hospital stay.

The limitations of our study are that it is a retrospective study and is performed only in a single center. However, it should be appreciated that continuous research will not be straightforward due to the nature of the study subject.

## *Conclusion*

In the treatment of acute calculous cholecystitis for patients who are not suitable for early surgery, delayed laparoscopic cholecystectomy after percutaneous cholecystectomy, is an effective treatment method.

***Scientific Responsibility Statement***

*The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.*

***Animal and human rights statement***

*All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.*

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***Conflict of interest***

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